DOCUMENT RESUME

ED 195 534 SP 017 154

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TITLE A Systems-Based Model for Designing Instruction.
PUB DATE 13 Nov 80
NOTE 23p.: Paper presented at the Annual Meeting of the Mid-South Educational Research Association (9th, New Orleans, LA, November 13, 1980).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Competency Based Teacher Education; Course Content; Course Descriptions; *Curriculum Development; Educational Objectives; Elementary Secondary Education; *Instructional Design; *Instructional Systems; Mastery Learning; *Program Evaluation; *Program Implementation; Teacher Effectiveness; Teacher Evaluation; Teaching Methods; Units of Study

ABSTRACT

The task of designing instruction encompasses three major activities: preparing instruction, instructing, and evaluating instruction. The major activities comprising instructional design are most effectively accommodated when (1) a systems-based format is employed and (2) they are addressed at the three levels of instructional design: the program syllabus, course syllabus, and instructional unit levels. A systems-based model appropriate to preparing, implementing, and evaluating instruction at the program syllabus, course syllabus, and instructional unit levels can be derived from the conceptual and research literature considering the crucial components of: identifying and justifying topical coverage; stating objectives; identifying and/or assessing prerequisites; sequencing content; selecting instructional methods, student assignments, and resources; providing for diagnostic-prescriptive teaching; and evaluating in a summative fashion. The paper also relates the topic of systems-based instructional design to such current issues as mastery learning, competency based education, evaluating teacher effectiveness, and criterion-referenced instruction. (Author/JD)

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A SYSTEMS-BASED MODEL FOR DESIGNING INSTRUCTION

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Paper Presented at the
Ninth Annual Meeting of the
Mid-South Educational Research Association

New Orleans, Louisiana

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November 13, 1980

SP 017 154

Abstract

The process of instructional design involves specifying and producing particular environmental situations in the classroom which incline students to react in such a way that a specified change occurs in their behavior (Merrill, 1971). More specifically, the task of designing instruction can be viewed as encompassing three major activities: preparing instruction, implementing instruction, and evaluating instruction. The basic premise of this paper is that the major activities comprising instructional design are most effectively accommodated when (1) a systems-based format is employed and (2) they are addressed at the three levels of instructional design: the program syllabus, course syllabus, and instructional unit levels.

Accordingly, this paper suggests a systems-based model appropriate to preparing, implementing, and evaluating instruction at the program syllabus, course syllabus, and instructional unit levels. In so doing, the conceptual and research literature are appealed to in considering such crucial components as the following: identifying and justifying topical coverage; stating objectives; identifying and/or assessing prerequisites; sequencing content; selecting instructional methods, student assignments, and resources; providing for diagnostic-prescriptive teaching; and evaluating in a summative fashion. The paper also relates the topic of systems-based instructional design to such current issues as mastery learning, competency-based education, evaluating teacher effectiveness, and criterion-referenced instruction.

A Systems-Based Model for Designing Instruction

As characterized by Banathy (1968), a system can be generally viewed as a deliberately designed entity comprised of interrelated and interacting components which are intended to function in an integrated fashion to attain some predetermined purpose. With this view in mind, it would appear that the instructional materials addressed by classroom teachers in their daily efforts would certainly merit consideration as representing a system within an educational context. Such would indeed be the case, for example, with the type of documentation that we typically associate with an instructional unit.

Implied in this view of system as an entity with the above-mentioned characteristics is the notion of systems approach as a goal-oriented process involving interdependent activities which are coordinated so as to generate certain products and/or to accomplish certain tasks. From this perspective, it would seem that the instructional activities engaged in by teachers would indeed lend themselves to a systems-based approach.

Closely related to this suggested linkage between instructional activities and the systems approach is the process of instructional design. As addressed by Merrill (1971), the process of designing instruction involves ". . . specifying and producing particular environmental situations which cause the learner to interact in such a way that a specified change occurs in his behavior" (p. 1). More

specifically, the task of designing instruction can be viewed as encompassing three major activities: preparing instruction, implementing instruction, and evaluating instruction.

The basic premise of this paper is that these major activities comprising instructional design are most effectively accommodated when (1) a systems-based format is employed and (2) they are addressed at the three levels of instructional design--the program syllabus, course syllabus, and instructional unit levels. Accordingly, this paper suggests a systems-based model appropriate to preparing, implementing, and evaluating instruction at the program syllabus, course syllabus, and instructional unit levels.

An Overview of the Systems-Based Model for Designing Instruction

The relationship between the phases and levels of instructional design is such that the tasks of preparing, implementing, and evaluating instruction represent (1) the means to generating instructional products or documents labelled program syllabus, course syllabus, and instructional unit and (2) the activities that are actually engaged in by the teacher in the attempt to interact with students at three levels in the instructional process. Figure 1 is a relatively simplistic illustration of the predominately deductive movement in the overall process of designing instruction at the program syllabus level (e.g., a four-year mathematics program in a high school), course syllabus level (e.g., an Algebra I course within the mathematics program), and instructional unit level (e.g., an Algebra I unit on solving quadratic equations).

Insert Figure 1 about here

Designing Instruction at the Program Syllabus and Course Syllabus Levels

Figure 2 illustrates the systems-based model for designing a program syllabus. Figure 3 represents a checklist for designing a program syllabus which is intended to accompany the model. The flowchart and its accompanying checklist are intended to serve as a schematic illustration and quasi-narrative, respectively, depicting the 11 components which comprise a program syllabus and, hence, need to be developed as one form of documenting the preparatory, implementation, and evaluative activities that have been designed for the particular instructional program being addressed. As the model and checklist indicate, the 11 components comprising the program syllabus include the following: program identification, program description, program rationale, program goals, program prerequisites, sequence of courses available in the program, categories of instructional methods used in the program, program requirements, available program resources, program calendar, and categories of program evaluation criteria for students and teachers.

Insert Figure 2 about here

Insert Figure 3 about here

Figures 4 and 5 represent the systems-based model and accompanying checklist, respectively, for designing a course syllabus. As was the case with the program syllabus, the course-oriented flowchart and checklist depict the 12 components which comprise a course syllabus designed from a systems-based perspective and, hence, represent the type of documentation appropriate to this level of instructional design. Those 12 components include the following: course identification, course description, course rationale, course goals, course prerequisites, sequence of instructional units comprising the course, instructional methods used in the course, course requirements, available course resources, course schedule, evaluation plan for the students, and evaluation criteria for course effectiveness.

Insert Figure 4 about here

Insert Figure 5 about here

Designing Instruction at the Instructional Unit Level

The instructional unit represents the most specific level at which instruction is designed. Accordingly, Figures 6 and 7 represent the systems-based model and checklist, respectively, for preparing, implementing, and evaluating an instructional unit.

Insert Figure 6 about here

Insert Figure 7 about here

Given the high degree of specificity called for at the instructional unit level, it is perhaps best to consider the components of a unit in the context of the three phases of the design effort.

Phase I: Preparing instruction. The unit description and rationale components are aspects of preparing an instructional unit and should reflect the unit goal specified earlier in the course syllabus. (It is presumed here that the delineation of course goals in the course syllabus reflects in large measure the goals of those units comprising the course.) With respect to the unit rationale, an attempt is made to justify for the student the inclusion of the unit in the course by an appeal to (1) its unique value as a dimension of the course, (2) its relationship to previous topics as a continuation of or sequel to that which has already been covered in the course, and (3) its relationship to future topics as, perhaps, a prerequisite or foundation to material yet to be addressed.

The performance objectives component is likewise an aspect of preparing instruction at the unit level. As elaborated on extensively in the progessional literature (e.g., Baker & Popham, 1973; Kibler, Cegala, Barker, & Miles, 1974; Mager, 1962), this component specifies in a detailed fashion the precise behavior (learning) for which the student will be held accountable subsequent to instruction, including an indication of the conditions under which the behavior is to be demonstrated and the proficiency level to be attained. This component

should serve to provide a basis for (1) communication among students, educators, and parents as to instructional expectations, (2) planning on the part of teacher and student, and (3) evaluation of student performance and instructor effectiveness. Furthermore, if the statement of performance objectives is delineated in terms of terminal and enabling objectives, then a mechanism is available for identifying the order in which the various learning tasks are to be mastered.

Another component of the unit which relates to the preparation of instruction involves the identification and/or assessment of prerequisite competencies. Since the progression in learning is from the known to the unknown, it is important that a determination be made of the exact prerequisite competencies required of, and hopefully possessed by, the student upon entry into the unit. Otherwise, the appropriate starting point in the presentation of a new topic would not be known by the teacher. Whether the prerequisite competencies appropriate to a unit are simply identified by the teacher for the benefit of students or actually assessed by the teacher is partially a function of the nature of the material to be covered. The former would probably suffice if the material is not highly sequential and hierarchical; otherwise, both the identification and assessment of prerequisite competencies might be in order.

A final component related to the preparation of instruction involves the delineation and sequencing of the topics comprising the unit via an advance organizer. As discussed by Ausubel (1963), an advance organizer is a written aid made available to a student

for the purpose of helping him relate the potentially meaningful material to be learned to the cognitive base (structure) which he already possesses. It provides the student with a subsumer which gives him a general overview of the more detailed material prior to his actual encounter with it. Although the typical format used with advance organizers is that of a written narrative which makes use of the student's established knowledge to increase the familiarity and learnability of the new material, other formats such as a topical outline, schematic illustration, flowchart, film, or audiotape may be employed.

Phase II: Implementing instruction. Quite obviously, the instructional methods selected and used by the teacher in a unit as well as the student activities assigned for completion in and out of class are features of implementing instruction. Of particular note here is the necessity for the instructional methods and student activities to reflect the performance objectives addressed in the unit. The logic behind this assertion is based on Gagné's (1977) contention that performance objectives serve as indicators of the type of learning being addressed, which in turn serve as determiners of the most appropriate instructional methods and learning activities. For example, the conditions of teaching and learning which should surround a conceptual learning task are different from the conditions associated with problem solving as a type of learning and, hence, should be recognized and accommodated by the instructor.

Instructional resources represent another facet of implementing instruction. The teacher has three realms from which to select:

(1) commercially-prepared resources, (2) instructor-prepared resources, and (3) resource personnel. In the case of the first two, whether one is selecting commercial resources or developing teacher-made materials, it is important that instructional design criteria be used in the selection or development process. The components of a systems-based instructional unit that are presently being addressed would suffice as guidelines for directing the selection/development effort. With respect to the utilization of resource personnel, one should be sensitive to possible discrepancies between the students' perceptions of credible models or significant others and the actual background of the person used as a resource.

Phase III: Evaluating instruction. As indicated in the systems-based model for designing an instructional unit, formative evaluation and learning correctives represent two important components. Although these two components are crucial sequels to the initial delivery of instruction on unit topics, and perhaps could be justified as aspects of implementing instruction, they are cited here as components of the evaluation phase which have a pronounced instructional value.

Formative evaluation (variously known in the present context as criterion-referenced trial testing, practice testing, or diagnostic testing) provides on-going, intermittent feedback to the teacher and student concerning the latter's progress at various stages in a given unit of instruction. This form of criterion-referenced testing occurs several times prior to the completion of the unit and makes possible the identification of learning deficiencies and the subsequent prescription of alternative remedial measures. Formative evaluation,

then, provides the "diagnostic" part of any attempt at diagnostic-prescriptive teaching.

As the flowchart indicates, the results of the formative testing suggest how effective or ineffective were the sequencing of topics via the advance organizer, the instructional methods, the student activities, and the resources used at various stages in the unit. In those instances when the formative test results indicate a learning deficiency on the part of a student, then learning correctives may be prescribed. These may include alternative ways of sequencing the material, delivering instruction, involving students via assignments, and employing resources. The learning correctives, then, represent the "prescriptive" part of any attempt at diagnostic-prescriptive teaching.

The summative evaluation component in this model refers to a criterion-referenced assessment at the end of the unit to determine a student's letter grade as based on demonstrated mastery of the unit's prespecified performance objectives. Finally, the unit evaluation component refers to (1) the students' opportunity to assess the instructional quality of the unit (perhaps via a brief questionnaire) and (2) the type of achievement distribution attained on the summative test (a negatively skewed curve suggesting instructional success).

Related Issues

The position advocated in this paper regarding the use of a systems-based approach to preparing, implementing, and evaluating instruction at the program syllabus, course syllabus, and instructional unit levels relates quite directly to such current issues as mastery

learning, competency-based education, evaluating teacher effectiveness, and criterion-referenced instruction. Major features permeating one or more of these four related issues include such themes as (1) promoting diagnostic-prescriptive teaching, (2) ensuring the attainment of essential competencies in a unit/course as a basis for academic promotion, (3) judging instructional effectiveness by an appeal to not only student cognitive performance and affective reaction but also the availability of tangible documentation (e.g., program syllabi, course syllabi, and instructional units) suggesting some degree of instructional design skills, and (4) promoting a balanced emphasis on both the instructional process per se and the outcomes of that process.

An adherence to the principles and practices suggested herein could serve to advance efforts in these four related areas. At the very least, a systematic approach to designing instruction might serve to place the teacher's task of preparing, implementing, and evaluating instruction on a scientific basis which recognizes the goal-oriented, multifaceted, and interactive nature of the instructional process.

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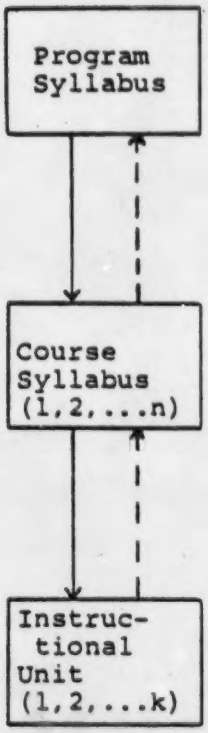

FIGURE 1:
SYSTEMS-BASED MODEL FOR DESIGNING INSTRUCTION

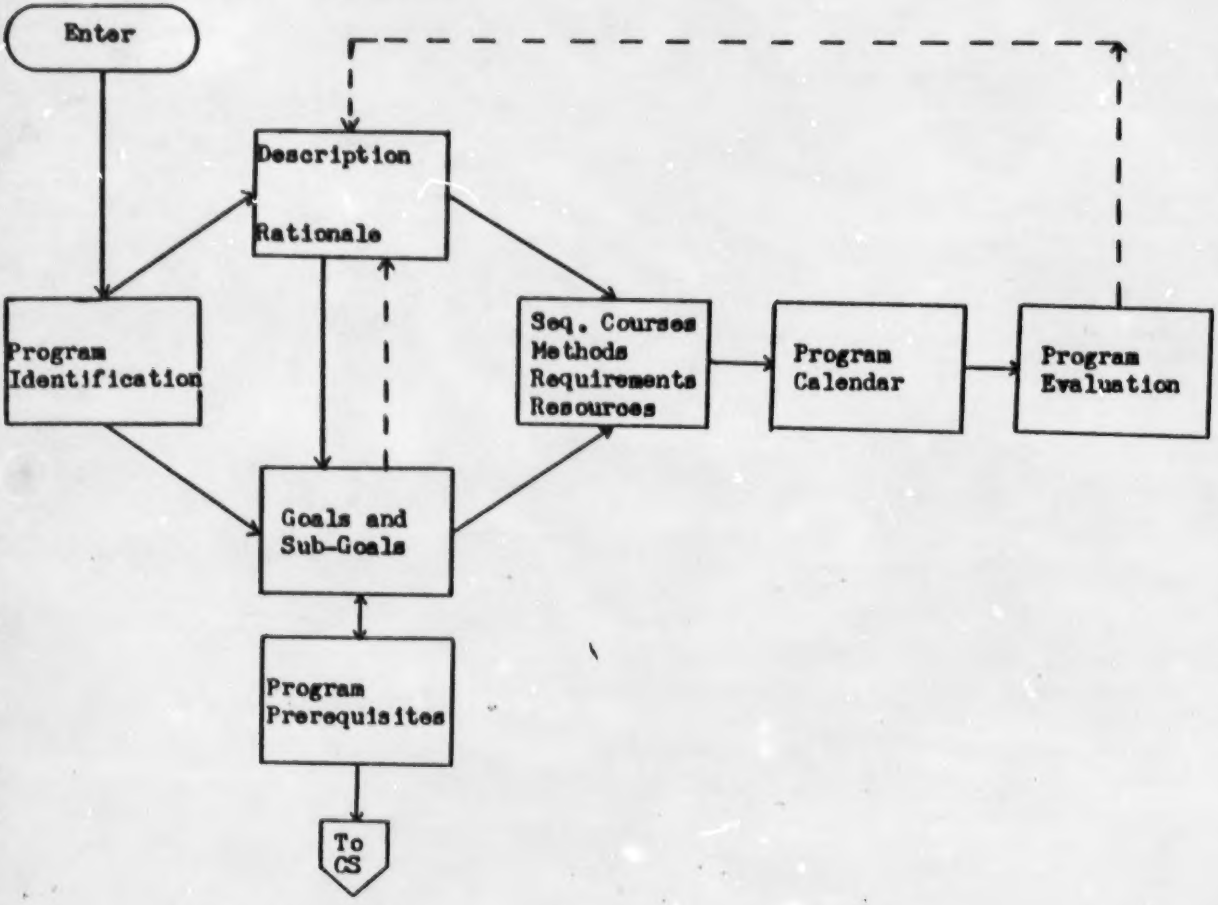

FIGURE 2:
SYSTEMS-BASED MODEL FOR DESIGNING A PROGRAM SYLLABUS

FIGURE 3:
CHECKLIST FOR DESIGNING A PROGRAM SYLLABUS

		Check When Completed
1.	Identify the program by name.	_____
2.	Describe in narrative form the subject-matter content of the program.	_____
3.	State the rationale for the existence of the program.	_____
4.	List the goals and sub-goals of the program.	_____
5.	Determine program prerequisites.	_____
6.	Outline the various courses which comprise the program.	_____
7.	Identify the broad categories of instructional methods employed in the program.	_____
8.	Identify and explain major requirements of the program as well as their corresponding deadlines, if any.	_____
9.	Specify the general types of resources available for the program.	_____
10.	Specify the program calendar with an emphasis on correlating program courses with the appropriate time frames in the program.	_____
11.	Describe the categories of evaluation criteria to be used in the program regarding students and instructors.	_____

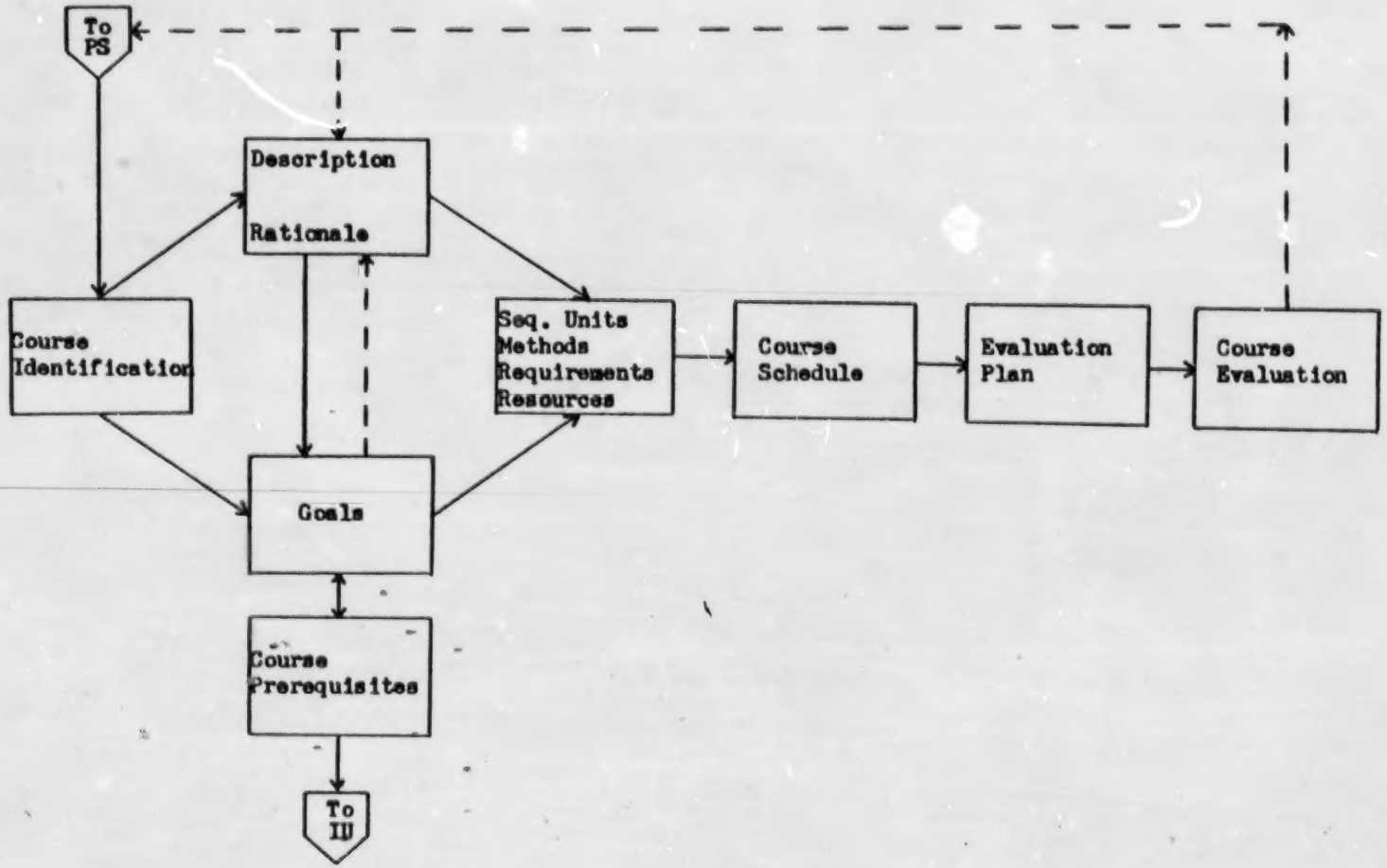

FIGURE 4:
SYSTEMS-BASED MODEL FOR DESIGNING A COURSE SYLLABUS

FIGURE 5:
CHECKLIST FOR DESIGNING A COURSE SYLLABUS

		Check When Completed
1.	Specify pertinent identifying information regarding the course (e.g., course title, instructor, time of class meeting, and room location).	_____
2.	Describe in narrative form the subject-matter content of the course.	_____
3.	State the rationale for the existence of the course.	_____
4.	List the goals or general objectives of the course.	_____
5.	Determine the prerequisites for the course.	_____
6.	Outline the various units which comprise the course.	_____
7.	Identify the instructional methods employed in the course.	_____
8.	Identify and explain major requirements of the course as well as their corresponding deadlines, if any.	_____
9.	Specify the resource materials utilized in the course.	_____
10.	Specify the course schedule with an emphasis on correlating items such as dates of class meetings, topics addressed, and assignments.	_____
11.	Describe the evaluation plan for the course relative to the following: evaluation approach (e.g., criterion-referenced), numerical range for grades, number and format of summative examinations, value of written assignments, and method of determining final grade.	_____
12.	Construct a course evaluation form which would be used to facilitate student feedback relative to the effectiveness of the course.	_____

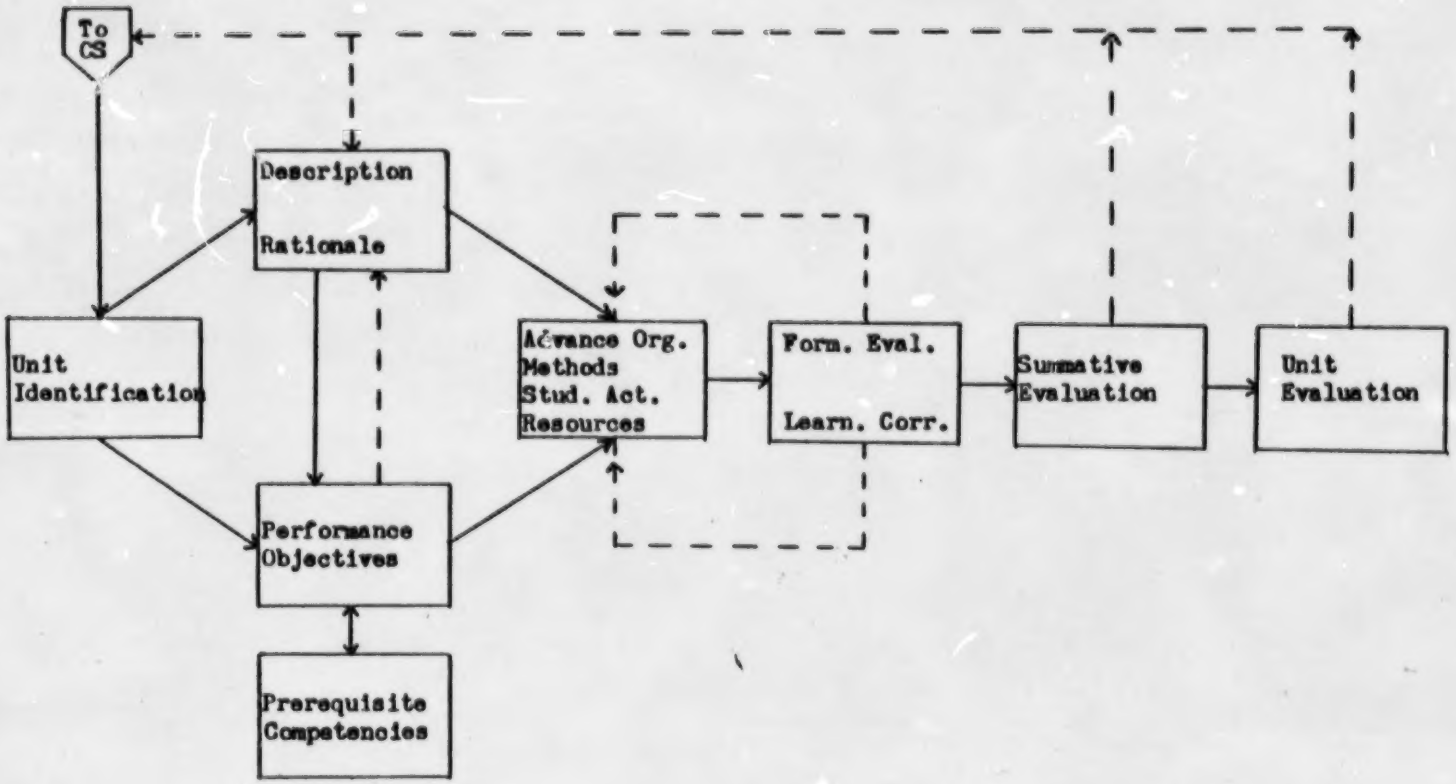

FIGURE 6:
SYSTEMS-BASED MODEL FOR DESIGNING AN INSTRUCTIONAL UNIT

FIGURE 7:
CHECKLIST FOR DESIGNING AN INSTRUCTIONAL UNIT

		Check When Completed
1.	Identify the topic addressed in the unit.	_____
2.	Describe in narrative form the subject-matter content of the unit.	_____
3.	State the rationale for the inclusion and location of the unit in the course.	_____
4.	List the performance objectives for the unit.	_____
5.	Identify and/or construct a test for prerequisite competencies.	_____
6.	Outline in detail (via an advance organizer) the various topics and subtopics which comprise the unit.	_____
7.	Identify the instructional methods used in the unit.	_____
8.	Identify the various learning activities in which the students will engage as they proceed through the unit.	_____
9.	Specify the resources utilized in the unit.	_____
10.	Construct a formative test which addresses itself to the performance objectives of the unit and which serves a diagnostic purpose.	_____
11.	(a) Identify various activities and assignments of a review and/or remedial nature to which a student would be recycled in order to correct certain learning deficiencies uncovered by the formative test.	_____
	(b) Prepare a form which reports the results of the formative test and which establishes a correspondence between items missed on the formative test and learning correctives.	_____
12.	Construct a summative test which addresses itself to the performance objectives of the unit.	_____
13.	Construct a unit evaluation form which would be used to facilitate student feedback relative to the effectiveness of the instructional unit.	_____